

## Patients with intracardiac masses: 12-year observation from a tertiary referral hospital

Intracardiac masses

Omer Tasbulak<sup>1</sup>, Arda Guler<sup>1</sup>, Mustafa Duran<sup>2</sup>, Ahmet Anil Sahin<sup>3</sup>, Begum Uygur<sup>1</sup>, Umit Bulut<sup>1</sup>, Yalcin Avcı<sup>1</sup>, Ali Riza Demir<sup>1</sup>, Serkan Kahraman<sup>1</sup>, Unal Aydin<sup>4</sup>, Mehmet Erturk<sup>1</sup>

<sup>1</sup> Department of Cardiology, University of Health Sciences, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Istanbul

<sup>2</sup> Department of Cardiology, University of Health Sciences, Konya Training and Research Hospital, Konya

<sup>3</sup> Department of Cardiology, School of Medicine, Istinye University, Istanbul

<sup>4</sup> Department of Cardiovascular Surgery, University of Health Sciences, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Istanbul, Turkey

### Abstract

**Aim:** Intracardiac masses are extremely rare and challenging to manage. Due to the rarity of the disease and the absence of data from large randomized clinical trials, recommendations for the diagnosis and management of intracardiac masses are still derived from expert opinion and observational cohort studies. In this study we aim to describe the epidemiological features, clinical characteristics, and prevalence of intracardiac masses.

**Material and Methods:** The records of 133 patients aged >18 who underwent open surgery due to confirmed intracardiac masses were investigated retrospectively. Demographic and clinical characteristics of the patients, the indication for the procedure, and postoperative outcomes were retrospectively analyzed. For isolated intracardiac masses, the mass location, final histopathologic diagnosis, concomitant clinical conditions, and preferred surgical approach were analyzed.

**Results:** The most common histopathologic diagnosis was atrial myxoma (n=62, 46.6%), followed by cardiac thrombus (n=33, 24.8%), and the most common location of the intracardiac masses was the left interatrial septum (n=48, 36.1%). The composite of all-cause mortality was the most common early outcome (n=11, 8.3%) while tumor-related mortality was the most common late outcome (n=15, 11.3%).

**Discussion:** Our data show that intracardiac masses have diverse etiology and various clinical manifestations, and they often require cardiac surgery. In order to prevent complications, careful assessment and optimal timing of surgery is mandatory.

### Keywords

Intracardiac Masses, Myxoma, Thrombus

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Corresponding Author: Omer Tasbulak, Istasyon Mahallesi, Turgut Ozal Bulvarı No: 11 Küçükçekmece, Istanbul, Turkey.

E-mail: omertasbulak@hotmail.com P: +90 507 293 61 70 F: +90 212 471 94 94

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-6307-5136>

## Introduction

Intracardiac masses are seen extremely rarely and they are challenging to manage. The associated disease states may be congenital, infectious, thrombotic, reactive, iatrogenic, or neoplastic lesions [1, 2]. Depending on the cardiac location and size, patients with intracardiac masses present with various symptoms including congestive heart failure, dyspnea, embolic events, and rhythm disturbances [3-5]. In addition, patients with cardiac metastasis experience constitutional symptoms such as fever, weight loss, fatigue, myalgia, night sweats, coughing, or leukocytosis [6]. Due to the extensive use of cardiac imaging modalities such as echocardiography, computed tomography (CT), and magnetic resonance imaging (MRI), patients may also present with no symptoms [7]. With respect to neoplastic lesions, the incidence of primary cardiac tumors is 0.02% with atrial myxomas accounting for the majority of cases. On the other hand, cardiac metastases are the most frequently observed type of cardiac neoplasms in the adult population [8, 9]. Owing to the increased risk of secondary complications, cardiac surgery is generally the preferred therapeutic approach for malignant cardiac neoplasms. On the other hand, patients with cardiac metastases predominantly originating from lymphomas may undergo systemic chemotherapy [10, 11].

Due to the rarity of the disease and the lack of data from large randomized clinical trials, recommendations for the diagnosis and management of intracardiac masses are still derived from expert opinion and observational cohort studies. Therefore, in this study we aim to describe the epidemiological features, clinical characteristics, and prevalence of intracardiac masses in a single tertiary-care hospital in Turkey while also focusing on the postoperative outcomes.

## Material and Methods

In this retrospective study, data were retrieved from cardiac surgical cases reported in the medical records and the electronic database of our hospital. The search for intracardiac masses within the electronic database was based on the Systematized Nomenclature of Medicine (SNOMED) codes routinely given to each patient. Data were available from January 1, 2009 through December 31, 2020, during which 133 consecutive patients aged >18 underwent cardiac surgery due to confirmed intracardiac masses. Demographic and clinical characteristics of the patients and the indication for the procedure were retrospectively analyzed. For isolated intracardiac masses, mass location, final histopathologic diagnosis, concomitant clinical conditions, and preferred surgical approach were analyzed. The obtained data pool was statistically analyzed. With respect to postoperative variables, early and late outcomes were also identified. In this study, early outcomes are defined as the development of atrial fibrillation (AF), stroke, cardiac tamponade, pulmonary complications, sternal wound infection, incomplete resection of intracardiac mass, and the composite of all-cause mortality, occurring less than one month after surgery. Late outcomes are defined as development of AF, infective endocarditis (IE), congestive heart failure, recurrence of intracardiac mass, tumor-related mortality, and the composite of all-cause mortality, occurring one month or more after surgery.

The study was approved by the Ethics Committee of the İstanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital.

## Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, USA). Conformity to normal distribution was analyzed with the Kolmogorov-Smirnov test. Data were expressed as mean±standard deviation (SD) for data with normal distribution, as median (25th-75th percentiles) for data with non-normal distribution, and as number (%) for categorical variables. The effects of different variables on mortality were calculated by univariate analysis for each. The variables for which the unadjusted p-value was <0.05 in univariate regression analysis were identified as potential risk markers and included in the multivariate regression model to detect independent predictors of mortality. Values of p<0.05 were considered statistically significant.

## Results

The baseline demographic and clinical characteristics of the study population are summarized in Table 1. The mean age of

**Table 1.** Baseline demographic characteristics of the patients and information about the diagnostic and histopathologic diagnoses of the intracardiac masses

	Patients (n=133)
Age, years	46.88±20.4
Gender (female), n (%)	75 (56.4)
Diabetes mellitus, n (%)	32 (24.1)
Hypertension, n (%)	43 (32.3)
Atrial fibrillation, n (%)	22 (16.5)
Chronic kidney disease, n (%)	14 (10.5)
Coronary artery disease, n (%)	11 (8.3)
Smoking, n (%)	30 (22.6)
Chronic obstructive pulmonary disease, n (%)	14 (10.5)
Hypertrophic obstructive cardiomyopathy, n (%)	1 (0.8)
Imaging modality, n (%)	
Transthoracic echocardiography	133 (100)
Transesophageal echocardiography	99 (74.4)
Computed tomography	28 (21.1)
Magnetic resonance imaging	24 (18)
Histopathologic diagnosis of intracardiac mass	
Benign, n (%)	
Myxoma	62 (46.6)
Fibroelastoma	10 (7.5)
Lipoma-hemangioma	10 (7.5)
Thrombus	33 (24.8)
Vegetation	8 (6.0)
Atrial septal defect device	1 (0.8)
Rhabdomyoma	2 (1.5)
Left atrial appendix aneurysm	1 (0.8)
Malignant, n (%)	
Lymphoma	1 (0.8)
Hepatocellular cancer	1 (0.8)
Fibrous histiocytoma	1 (0.8)
Idiopathic metastasis	1 (0.8)
Leiomyosarcoma	2 (1.5)

patients at the time of surgery was 46.88±20.4 years and 56.4% were female. All patients had ejection fraction of >50%. The majority of the patients presented with obstructive symptoms

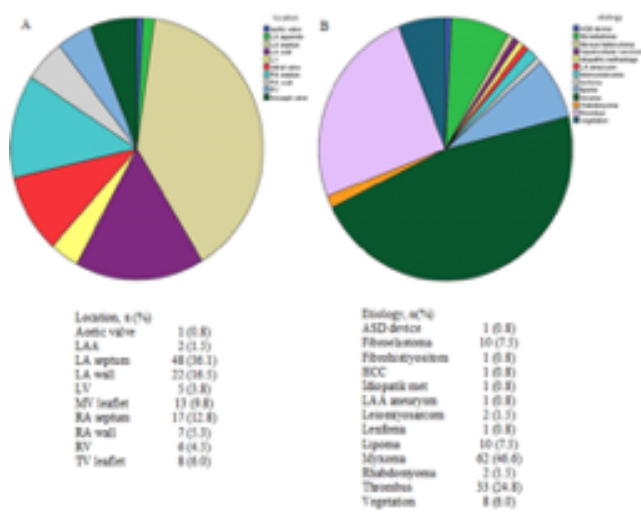
**Table 2.** Procedural information and follow-up clinical end points of the patients

Patients (n=133)	
<b>Location, n (%)</b>	
- Left atrial septum	48 (36.1)
- Left atrial wall	22 (16.5)
- Left atrial base	4 (3.0)
- Right atrial septum	17 (12.8)
- Right atrial wall	7 (5.3)
- Right ventricle	6 (4.5)
- Left ventricle	5 (3.8)
- Mitral valve leaflet	13 (9.8)
- Tricuspid valve leaflet	8 (6.0)
- Aortic valve	1 (0.8)
- Left atrial appendix	2 (1.5)
<b>Surgical approach, n (%)</b>	
- Superior transseptal	77 (57.9)
- Left atriotomy	10 (7.5)
- Right atriotomy	37 (27.8)
- Right ventriculotomy	2 (1.5)
- Aortotomy	2 (1.5)
- Left ventriculotomy	1 (0.8)
- Right atriotomy-aortotomy	1 (0.8)
- Superior transseptal-aortotomy	2 (1.5)
<b>Robotic surgery, n (%)</b>	
Robotic surgery, n (%)	14 (10.5)
<b>Mini-thoracotomy, n (%)</b>	
Mini-thoracotomy, n (%)	2 (1.5)
<b>Follow-up time, months</b>	
Follow-up time, months	31 (14.5-62.5)
<b>CPB time, minutes</b>	
CPB time, minutes	87.4±36.6
<b>Aortic clamp time, minutes</b>	
Aortic clamp time, minutes	50.2±24.9
<b>Hypothermia, minutes</b>	
Hypothermia, minutes	30.0±2.21
<b>Early outcomes, n (%)</b>	
Mortality	11 (8.3)
Atrial fibrillation	7 (5.3)
Sternal wound infection	1 (0.8)
Stroke	2 (1.5)
Incomplete resection	3 (2.3)
Pulmonary complication	6 (4.5)
Postoperative pericardial tamponade	3 (2.3)
<b>Late outcomes, n (%)</b>	
Recurrence	3 (2.3)
Tumor-related mortality	1 (0.8)
All-cause mortality	15 (11.3)
Congestive heart failure	2 (1.5)
Infective endocarditis	1 (0.8)
Atrial fibrillation	2 (1.5)
<b>Mortality, n (%)</b>	
Mortality, n (%)	27 (20.3)
<b>Time to mortality, months</b>	
Time to mortality, months	9.5 (0-23.75)

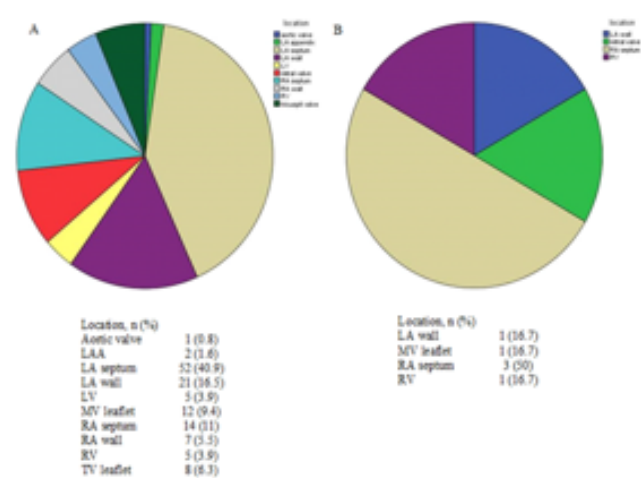
**Table 3.** Independent predictors of mortality of patients

Multivariate analysis			
	Odds ratio	95% Confidence interval (lower-upper)	p
Stroke	4.421	1.272-15.369	0.019
Malignancy	43.063	4.230-438.431	0.001

(n=79, 59.4%) and mitral valve insufficiency (n=86, 64.7%) was found to be more prevalent than other valvular conditions. Diagnostic and histopathologic information about the patients is also provided in Table 1. All patients underwent transthoracic echocardiographic assessment of the cardiac masses before the planned procedures. Among all cases, 99 patients (74.4%) underwent transesophageal echocardiography assessment, 28 patients (21.1%) underwent CT evaluation, and 24 patients (18%) underwent MRI evaluation for detection of intracardiac masses. The most common histopathologic diagnosis was atrial myxoma (n=62, 46.6%), followed by cardiac thrombus (n=33, 24.8%), and the most common location for the intracardiac mass was the left atrial septum (n=48, 36.1%). Figure 1 shows the localizations and etiologies of the intracardiac masses in all patients. Figure 2 demonstrates the localizations of the benign (A) and malignant (B) masses of the heart. Regarding malignant neoplasms, the incidence of leiomyosarcomas was higher than that of other malignant neoplasms (n=2, 1.5%). Locations of the masses and information about surgical procedures are provided in Table 2. Among the preferred surgical techniques, the superior transseptal approach was the most commonly applied method (n=77, 57.9%). Robotically assisted surgery



**Figure 1.** Localizations (A) and etiologies (B) of the intracardiac masses in all patients



**Figure 2.** Localizations of the benign (A) and malignant (B) masses of the heart

was performed for 14 patients (10.5%) and right anterior mini-thoracotomy surgery was conducted for 2 patients (1.5%). With respect to postoperative outcomes, the composite of all-cause mortality was the most common early outcome (n=11, 8.3%), while all-cause mortality was the most common late outcome (n=15, 11.3%). The mean time for mortality was 9.5 (0-23.75) months (Table 2). According to our data, development of cerebrovascular accident and presence of malignant neoplasm were found to be independent predictors of mortality (Table 3).

## Discussion

This study represents the largest report from Turkey to investigate patients undergoing cardiac surgery due to confirmed intracardiac masses and it is also the largest study to evaluate the utility of contemporary surgical techniques for the treatment of intracardiac masses. According to our data, primary intracardiac masses were most commonly atrial myxomas and were mostly benign. Of the total 62 patients with atrial myxomas, the most common location was the left atrial septum (n=42, 67.7%). After myxomas, the most common etiology among cardiac masses was observed to be thrombus, and thrombi were most often located in the left atrial wall. Among malignant masses, leiomyosarcomas were the most common, and malignant masses were most frequently localized in the right atrial septum. As a result of our study, it was found that intracardiac masses most frequently caused obstruction symptoms. However, malignancy was the most important indicator of mortality in these patients.

Although patients with intracardiac masses present with diverse symptoms, the most common symptoms observed in the patient population in our study were associated with obstruction. These symptoms were mainly characterized by dyspnea and peripheral edema, together with nonspecific symptoms such as weakness and fatigue. Apart from this, in these patients, embolism and conduction anomalies could be seen, as also shown in previous studies [12-14]. Even when cardiac masses are detected in these patients, patients may be asymptomatic, a situation that may cause some difficulties for diagnosis.

Regarding the incidence and characteristics of the intracardiac masses, our findings were comparable with the results of previous reports. In a recently published multicenter study, Tasdemir et al. evaluated 40 patients who underwent surgery for intracardiac masses. Similar to our data in this study, they reported that intracardiac masses were frequently detected in left atrial locations and that myxomas were the most common type [15]. In previous studies, it has also been reported that leiomyosarcomas and osteosarcomas are the most common malignant masses [16, 17]. Our study thus seems to be compatible with the literature, with similar results. In a study by Isogai et al. evaluating 1317 patients, the most important predictor of mortality in patients with cardiac masses was found to be malignancy, as in our study [18].

In our study, 4.5% of the cardiac masses (6/133) were malignant and the most common location among those malignant masses was the right atrial septum (n=3, 50%). The incidence of malignant cardiac masses was significantly lower compared to previous studies and the most plausible explanation for this outcome lies in the characteristics of our institution [19].

Patients with cardiac metastases for whom the treatment of choice was complete resection in combination with systemic chemo- or radiotherapy were referred to our hospital. On the other hand, patients with cardiac metastases predominantly originating from peripheral solid tumors or lymphomas who were not eligible for cardiac surgery due to the course of the disease were not referred to our hospital.

## Study Limitations

Despite the long follow-up period, this was a single-center, retrospective study with a relatively small number of patients due to the rarity of the disease. Thus, prospective multicenter studies with larger patient populations will provide additional information for understanding the clinical characteristics and prevalence of intracardiac masses and therapeutic approaches. Finally, this study was designed for evaluating patients who underwent cardiac surgery due to confirmed intracardiac masses. We did not investigate patients with suspected intracardiac masses. Although cardiac thrombus was the second-most common benign intracardiac mass with a relatively low prevalence, we only evaluated patients for whom cardiac surgery was the only treatment option for cardiac thrombus.

## Conclusion

Intracardiac masses have diverse pathological features, are associated with adverse clinical manifestations, and often require cardiac surgery. Despite the identification of various intracardiac masses, atrial myxomas are found to be the most common primary intracardiac masses in adults. In addition, the development of cerebrovascular accident following surgery and the presence of malignant neoplasms are significantly associated with postoperative mortality.

## Scientific Responsibility Statement

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

## Animal and human rights statement

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

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## Conflict of interest

*None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.*

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